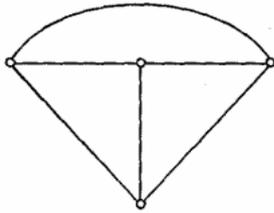


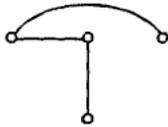
ELECTRONICS & COMMUNICATION ENGINEERING

ONE MARK QUESTIONS

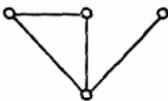
1. Consider the network graph shown in the figure. Which one of the following is NOT a 'tree' of this graph?



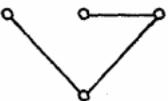
(a.)



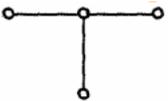
(b.)



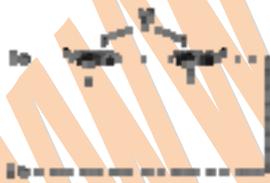
(c.)



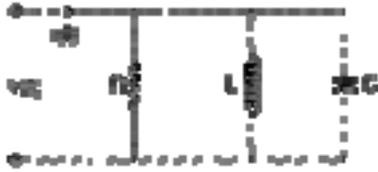
(d.)



2. The equivalent inductance measured between the terminals 1 and 2 for the circuit shown in the figure is

(a.) $L_1 + L_2 + M$ (b.) $L_1 + L_2 - M$ (c.) $L_1 + L_2 + 2M$ (d.) $L_1 + L_2 - 2M$

3. The circuit shown in the figure, with $R = \frac{1}{3}\Omega$, $L = \frac{1}{4}H$, $C = 3F$ has input voltage $v(t) \sin 2t$. The resulting current $i(t)$ is



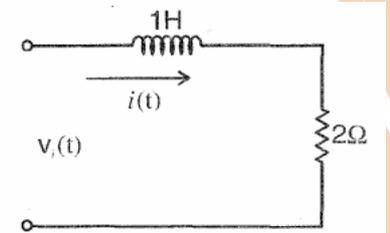
- (a.) $5 \sin (2t + 53.1^\circ)$
- (b.) $5 \sin (2t - 53.1^\circ)$
- (c.) $25 \sin (2t + 53.1^\circ)$
- (d.) $25 \sin (2t - 53.1^\circ)$

4. For the circuit shown in the figure, the time constant $RC = 1 \text{ ms}$. The input voltage is $v_i(t) = \sqrt{2} \sin 10^3 t$. The output voltage $v_o(t)$ is equal to

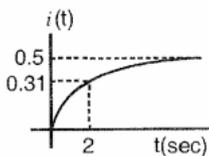


- (a.) $\sin(10^3 t - 45^\circ)$
- (b.) $\sin(10^3 t + 45^\circ)$
- (c.) $\sin(10^3 t - 53^\circ)$
- (d.) $\sin(10^3 t + 53^\circ)$

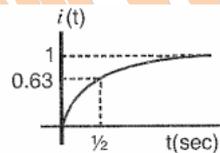
5. For the R-L circuit shown in the figure, the input voltage $v(t) = u(t)$. The current $i(t)$ is



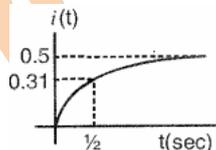
(a.)



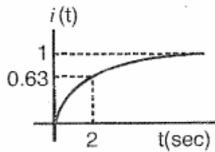
(b.)



(c.)

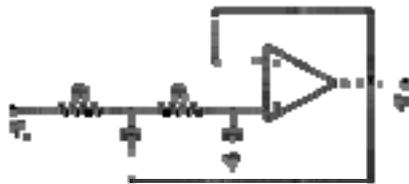


(d.)

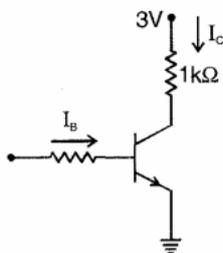


6. The impurity commonly used for realizing the base region of a silicon n-p-n transistor is
- Gallium
 - Indium
 - Boron
 - Phosphorus
7. If for a silicon n-p-n transistor, the base-to-emitter voltage (V_{BE}) is 0.7 V and the collector-to-base voltage (V_{CB}) is 0.2V, then the transistor is operating in the
- normal active mode
 - saturation mode
 - inverse active mode
 - cutoff mode
8. Consider the following statements S 1 and S2.
- S1: The β of a bipolar transistor reduces if the base width is increased.
- S2: The β of a bipolar transistor increases if the doping concentration in the base is increased.
- Which one of the following is correct?
- S1 is FALSE and S2 is TRUE
 - Both S1 and S2 are TRUE
 - Both S1 and S2 are FALSE
 - S1 and TRUE and S2 is FALSE
9. Given figure is the voltage transfer characteristic of
-
- The graph shows the voltage transfer characteristic (VTC) of an inverter. The vertical axis is labeled v_o and the horizontal axis is labeled v_i . The curve starts at a high output voltage for a low input voltage, then drops sharply to a low output voltage as the input voltage increases, characteristic of an inverter.
- an NMOS inverter with enhancement mode transistor as load
 - an NMOS inverter with depletion mode transistor as load
 - a CMOS inverter
 - a BJT inverter
10. An ideal op-amp is an ideal
- voltage controlled current source
 - voltage controlled voltage source

- (c.) current controlled current source
 (d.) current controlled voltage source
11. Voltage series feedback (also called series-shunt feedback) results in
- (a.) increase in both input and output impedances
 (b.) decrease in both input and output impedances
 (c.) increase in input impedance and decrease in output impedance
 (d.) decrease in input impedance and increase in output impedance
12. The circuit in the figure is a



- (a.) low-pass filter
 (b.) high-pass filter
 (c.) band-pass filter
 (d.) band-reject filter
13. Assuming $V_{CEsat} = 0.2V$ and $\beta = 50$, the minimum base current (I_B) required to drive the transistor in the figure to saturation is



- (a.) $56 \mu A$
 (b.) $140 mA$
 (c.) $60 mA$
 (d.) $3 mA$
14. A master-slave flip-flop has the characteristic that
- (a.) change in the input immediately reflected in the output
 (b.) change in the output occurs when the state of the master is affected
 (c.) change in the output occurs when the state of the slave is affected
 (d.) both the master and the slave states are affected at the same time
15. The range of signed decimal numbers that can be represented by 6-bit 1's complement number is
- (a.) -31 to +31
 (b.) -63 to +63
 (c.) -64 to +63

(d.) -32 to + 31

16. A digital system is required to amplify a binary-encoded audio signal. The user should be able to control the gain of the amplifier from a minimum to a maximum in 100 increments. The minimum number of bits required to encode, in straight binary, is

(a.) 8

(b.) 6

(c.) 5

(d.) 7

17. Choose the correct one from among the alternatives A, B, C, D after matching an item from Group 1 with the most appropriate item in Group 2.

Group 1

A. Shift register

B. Counter

C. Decoder

Group 2

1. Frequency division

2. Addressing in memory chips

3. Serial to parallel data conversion

Codes:

	A	B	C
(a.)	3	2	1
(b.)	3	1	2
(c.)	2	1	3
(d.)	1	2	2

18. The figure shows the internal schematic of a TTL AND-OR-Invert (AOI) gate. For the inputs shown in the figure, the output Y is



(a.) 0

(b.) 1

(c.) AB

(d.) \overline{AB}

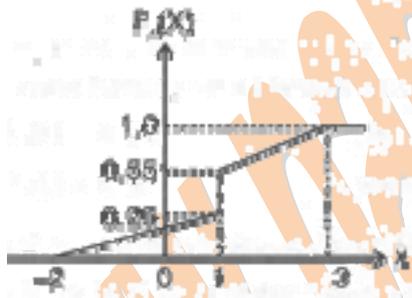
19. The impulse response $h[n]$ of a linear time-invariant system is given by

$$h[n] = u[n+3] + u[n-2] - 2u[n-7]$$

where $u[n]$ is the unit step sequence. The above system is

- (a.) stable but not causal
(b.) stable and causal
(c.) causal but unstable
(d.) unstable and not causal
20. The Fourier transform of a conjugate symmetric function is always
(a.) imaginary
(b.) conjugate anti-symmetric
(c.) real
(d.) conjugate symmetric
21. The z-transform of a system is $H(z) = \frac{z}{z-0.2}$. If the ROC is $|z| < 0.2$, then the impulse response of the system is
(a.) $(0.2)^n u[n]$
(b.) $(0.2)^n u[-n-1]$
(c.) $-(0.2)^n u[n]$
(d.) $-(0.2)^n u[-n-1]$
22. The gain margin for the system with open-loop transfer function $G(s)H(s) = \frac{2(1+s)}{s^2}$, is
(a.) ∞
(b.) 0
(c.) 1
(d.) $-\infty$
23. Given $G(s)H(s) = \frac{K}{s(s+1)(s+3)}$, the point of intersection of the asymptotes of the root loci with the real axis is
(a.) -4
(b.) 1.33
(c.) -1.33
(d.) 4
24. In a PCM system, if the code word length is increased from 6 to 8 bits, the signal to quantization noise ratio improves by the factor
(a.) 8/6
(b.) 12
(c.) 16
(d.) 8

25. An AIVI signal is detected using an envelop detector. The carrier frequency and modulating signal frequency are 1 MHz and 2 kHz respectively. An appropriate value for the time constant of the envelop detector is
- (a.) 500 μ sec
 - (b.) 20 μ sec
 - (c.) 0.2 μ sec
 - (d.) 1 μ sec
26. An AM signal and a narrow-band FM signal with identical carriers, modulating signals and modulation indices of 0.1 are added together. The resultant signal can be closely approximated by
- (a.) broadband FM
 - (b.) SSB with carrier
 - (c.) DSB-SC
 - (d.) SSB without carrier
27. In the output of a DM speech encoder, the consecutive pulses are of opposite polarity during time interval $t_1 \leq t \leq t_2$. This indicates that during this interval
- (a.) the input to the modulator is essentially constant
 - (b.) the modulator is going through slope overload
 - (c.) the accumulator is in saturation
 - (d.) the speech signal is being sampled at the Nyquist rate
28. The distribution function $F_X(x)$ of a random variable X is shown in the figure. The probability that $X = 1$ is

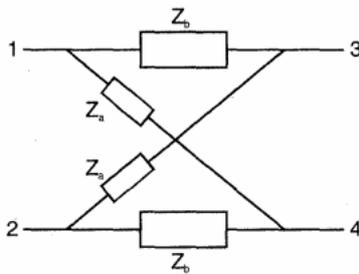


- (a.) zero
 - (b.) 0.25
 - (c.) 0.55
 - (d.) 0.30
29. The phase velocity of an electromagnetic wave propagating in a hollow metallic rectangular waveguide in the TE_{10} mode is
- (a.) equal to its group velocity
 - (b.) less than the velocity of light in free space
 - (c.) equal to the velocity of light in free space
 - (d.) greater than the velocity of light in free space

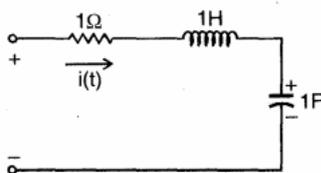
30. Consider a lossless antenna with a directive gain of +6dB. If 1 mW of power is fed to it the total power radiated by the antenna will be
- (a.) 4 mW
(b.) 1 mW
(c.) 7 mW
(d.) 1/4 mW

TWO MARKS QUESTIONS

31. For the lattice circuit shown in the figure, $Z_a = j2\Omega$ and $Z_b = 2\Omega$. The values of the open circuit impedance parameters $Z = \begin{bmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix}$ are



- (a.) $\begin{bmatrix} 1-j & 1+j \\ 1+j & 1+j \end{bmatrix}$
 (b.) $\begin{bmatrix} 1-j & 1+j \\ -1+j & 1-j \end{bmatrix}$
 (c.) $\begin{bmatrix} 1+j & 1+j \\ 1-j & 1-j \end{bmatrix}$
 (d.) $\begin{bmatrix} 1+j & -1+j \\ -1+j & 1+j \end{bmatrix}$
32. The circuit shown in the figure has initial current $i_L(0^-) = 1A$ through the inductor and an initial voltage $v_C(0^-) = 1V$ across the capacitor. For input $v(t) = u(t)$, the Laplace transform of the current $i(t)$ for $t \geq 0$ is



- (a.) $\frac{s}{s^2 + s + 1}$

(b.) $\frac{s+2}{s^2+s+1}$

(c.) $\frac{s-2}{s^2+s+1}$

(d.) $\frac{s-2}{s^2+s+1}$

33. The transfer function $H(s) = \frac{V_o(s)}{V_i(s)}$ of an R-L-C circuit is given by $H(s) = \frac{10^6}{s^2 + 20s + 10^6}$. The

Quality factor (Q-factor) of this circuit is

(a.) 25

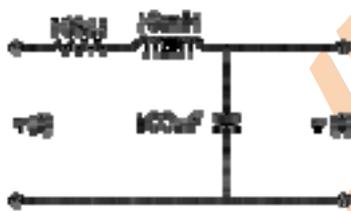
(b.) 50

(c.) 100

(d.) 5000

34. For the circuit shown in the figure, the initial conditions are zero. Its transfer function $H(s) = \frac{V_c(s)}{V_i(s)}$

is



(a.) $\frac{1}{s^2 + 10^6 s + 10^6}$

(b.) $\frac{10^6}{s^2 + 10^3 s + 10^6}$

(c.) $\frac{10^3}{s^2 + 10^3 s + 10^6}$

(d.) $\frac{10^6}{s^2 + 10^6 s + 10^6}$

35. Consider the following statements S_1 and S_2

S_1 : At the resonant frequency the impedance of a series RL-C circuit is zero.

S_2 : In a parallel G-L-C circuit, increasing the conductance G results in increase in its Q factor.

Which one of the following is correct?

(a.) S_1 is FALSE and S_2 is TRUE(b.) Both S_1 and S_2 are TRUE(c.) S_1 is TRUE and S_2 is FALSE(d.) Both S_1 and S_2 are FALSE

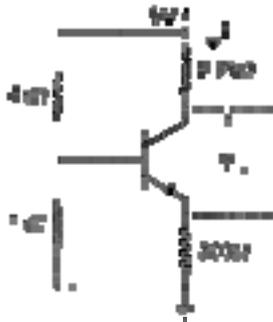
36. In an abrupt p-n junction. the doping concentrations on the p-side and n-side are $N_A = 9 \times 10^{16} / \text{cm}^3$ and $N_D = 10^{16} / \text{cm}^3$ respectively. The p-n junction is reverse biased and the total depletion width is $3 \mu\text{m}$. The depletion width on the p-side is
- $2.7 \mu\text{m}$
 - $0.3 \mu\text{m}$
 - $2.25 \mu\text{m}$
 - $0.75 \mu\text{m}$
37. The resistivity of a uniformly doped n-type silicon sample is $0.5 \Omega\text{-cm}$. If the electron mobility (μ_n) is $1250 \text{ cm}^2/\text{V-sec}$ and the charge of an electron is 1.6×10^{-19} Coulomb, the donor impurity concentration (N_D) in the sample is
- $2 \times 10^{16} / \text{cm}^3$
 - $1 \times 10^{16} / \text{cm}^3$
 - $2.6 \times 10^{15} / \text{cm}^3$
 - $2 \times 10^{15} / \text{cm}^3$
38. Consider an abrupt p-n junction. Let V_{bi} be the built-in potential of this junction and V_R be the applied reverse bias. If the junction capacitance (C_j) is 1 pF for $V_{bi} + V_R = 1 \text{ V}$, then for $V_{bi} + V_R = 4 \text{ V}$, C_j will be
- 4 pF
 - 2 pF
 - 0.25 pF
 - 0.5 pF
39. Consider the following statements S1 and S2.
- S1: The threshold voltage (V_T) of a MOS capacitor decreases with increase in gate oxide thickness
- S2: The threshold voltage (V_T) of a MOS capacitor decreases with increase in substrate doping concentration
- S1 is FALSE and S2 is TRUE
 - Both S1 and S2 are TRUE
 - Both S1 and S2 are FALSE
 - S1 is TRUE and S2 is FALSE
40. The drain of an n-channel MOSFET is shorted to the gate so that $V_{GS} = V_{DS}$. The threshold voltage (V_T) of MOSFET is 1 V . If the drain current (I_D) is 1 mA for $V_{GS} = 2 \text{ V}$, then for $V_{GS} = 3 \text{ V}$, I_D is
- 2 mA
 - 3 mA
 - 9 mA
 - 4 mA
41. The longest wavelength that can be absorbed by silicon, which has the bandgap of 1.12 eV , is $1.1 \mu\text{m}$. If the longest wavelength that can be absorbed by another material is $0.87 \mu\text{m}$, then the bandgap of this material is

- (a.) 1.416 eV
- (b.) 0.886 eV
- (c.) 0.854 eV
- (d.) 0.706 eV

42. The neutral base width of a bipolar transistor, biased in the active region, is $0.5 \mu\text{m}$. The maximum electron concentration and the diffusion constant in the base are $10^{14} / \text{cm}^3$ and $D_n = 25 \text{ cm}^2 / \text{sec}$ respectively. Assuming negligible recombination in the base, the collector current density is (the electron charge is 1.6×10^{-19} coulomb)

- (a.) 800 A/cm^2
- (b.) 8 A/cm^2
- (c.) 200 A/cm^2
- (d.) 2 A/cm^2

43. Assuming that the β of the transistor is extremely large and $V = 0.7\text{V}$, I_C and V_{CE} in the circuit shown in the figure are

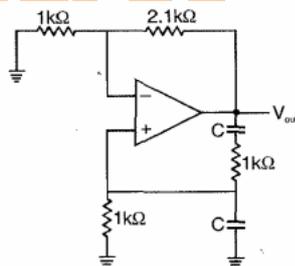


- (a.) $I_C = 1\text{mA}$, $V_{CE} = 4.7 \text{ V}$
- (b.) $I_C = 0.5 \text{ mA}$, $V_{CE} = 3.75 \text{ V}$
- (c.) $I_C = 1 \text{ mA}$, $V_{CE} = 2.5 \text{ V}$
- (d.) $I_C = 0.5 \text{ mA}$, $V_{CE} = 3.9 \text{ V}$

44. A bipolar transistor is operating in the active region with a collector current of 1mA . Assuming that the β of the transistor is 100 and the thermal voltage (V_T) is 25mV , the trans-conductance (g_m) and the input resistance (r_π) of the transistor in the common emitter configuration, are

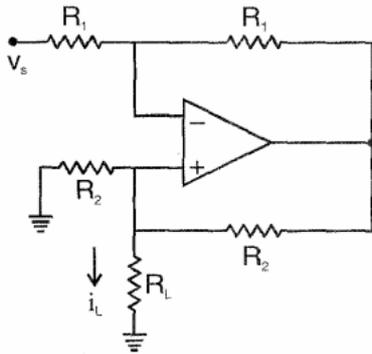
- (a.) $g_m = 25\text{mA/V}$ and $r_\pi = 15.625 \text{ k}\Omega$
- (b.) $g_m = 40\text{mA/V}$ and $r_\pi = 4.0 \text{ k}\Omega$
- (c.) $g_m = 25\text{mA/V}$ and $r_\pi = 2.5 \text{ k}\Omega$
- (d.) $g_m = 40\text{mA/V}$ and $r_\pi = 2.5 \text{ k}\Omega$

45. The value of C required for sinusoidal oscillations of frequency 1 kHz in the circuit of the figure is



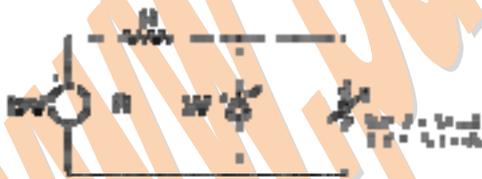
- (a.) $\frac{1}{2\pi} \mu F$
 (b.) $2\pi \mu F$
 (c.) $\frac{1}{2\pi\sqrt{6}} \mu F$
 (d.) $2\pi\sqrt{6} \mu F$

46. In the op-amp circuit given in the figure, the load current i_L is



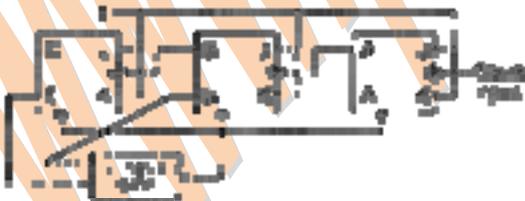
- (a.) $-\frac{v_s}{R_2}$
 (b.) $\frac{v_s}{R_2}$
 (c.) $-\frac{v_s}{R_L}$
 (d.) $\frac{v_s}{R_1}$

47. In the voltage regulator shown in the figure, the load current can vary from 100 mA to 500 mA. Assuming that the Zener diode is ideal (i.e., the Zener knee current is negligibly small and Zener resistance is zero in the breakdown region), the value of R is



- (a.) 7Ω
 (b.) 70Ω
 (c.) $\frac{70}{3}\Omega$
 (d.) 14Ω

48. In a full-wave rectifier using two ideal diodes, V_{dc} and V_m are the dc and peak values of the voltage respectively across a resistive load. If PIV is the peak inverse voltage of the diode, then the appropriate relationships for this rectifier are
- (a.) $V_{dc} = \frac{V_m}{\pi}$, $PIV = 2V_m$
- (b.) $V_{dc} = 2\frac{V_m}{\pi}$, $PIV = 2V_m$
- (c.) $V_{dc} = 2\frac{V_m}{\pi}$, $PIV = V_m$
- (d.) $V_{dc} = \frac{V_m}{\pi}$, $PIV = V_m$
49. The minimum number of 2 to -1 multiplexers required to realize a 4- to 1 multiplexer is
- (a.) 1
- (b.) 2
- (c.) 3
- (d.) 4
50. The Boolean expression $AC + B\bar{C}$ is equivalent to
- (a.) $\bar{A}C + B\bar{C} + Ac c$
- (b.) $\bar{B}C + AC + B\bar{C} + \bar{A}C\bar{B}$
- (c.) $AC + B\bar{C} + \bar{B}C + ABC$
- (d.) $ABC + \bar{A}B\bar{C} + AB\bar{C} + A\bar{B}C$
51. 11001, 1001 and 111001 correspond to the 2's complement representation of which one of the following sets of number?
- (a.) 25, 9 and 57 respectively
- (b.) -6, -6 and -6 respectively
- (c.) -7, -7 and -7 respectively
- (d.) -25, -9 and -57 respectively
52. In the modulo-6 ripple counter shown in the figure, the output of the 2-input gate is used to clear the J-K flip-flops.



The 2-input gate is

- (a.) a NAND gate
- (b.) a NOR gate
- (c.) an OR gate

(d.) an AND gate

53. A Boolean function f of two variables x and y is defined as follows:

$$f(0,0) = f(0,1) = f(1,1) = 1; f(1,0) = 0$$

Assuming complements of x and y are not available, a minimum cost solution for realizing using only 2-input NOR gates and 2-input OR gates (each having unit cost) would have a total cost of

(a.) unit

(b.) 4 unit

(c.) 3 unit

(d.) 2 unit

54. A 1 kHz sinusoidal signal is ideally sampled at 1500 samples/sec and the sampled signal is passed through an ideal low-pass filter with cut-off frequency 800 Hz. The output signal has the frequency

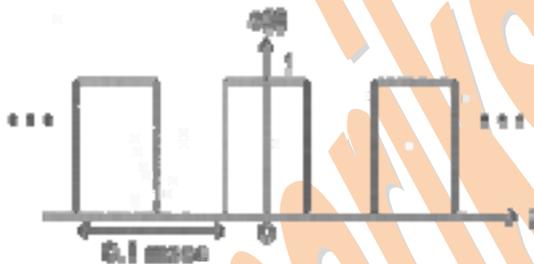
(a.) zero Hz

(b.) 0.75 kHz

(c.) 0.5 kHz

(d.) 0.25 kHz

55. A rectangular pulse train $s(t)$ as shown in the figure is convolved with the signal $\cos^2(4\pi \times 10^3 t)$. The convolved signal will be a



(a.) DC

(b.) 12 kHz sinusoid

(c.) 8 kHz sinusoid

(d.) 14 kHz sinusoid

56. Consider the sequence

$$x[n] = [-4 - j5 \quad 1 + j2 \quad 4]$$

The conjugate anti symmetry part of the sequence is

(a.) $[-4 - j2.5 \quad j2 \quad 2 - j2.5]$

(b.) $[-j2 - 5 \quad 1 + j2 \quad 4]$

(c.) $[-j5 \quad j2 \quad 0]$

(d.) $[4 \quad 1 \quad 4]$

57. A causal LTI system is described by the difference equation

$$2y[n] = \alpha y[n-2] - 2x[n] + \beta x[n-1]$$

The system is stable only if

- (a.) $|\alpha| = 2, |\beta| < 2$
- (b.) $|\alpha| > 2, |\beta| > 2$
- (c.) $|\alpha| < 2$, any value of β
- (d.) $|\beta| < 2$, any value of α

58. The impulse response $h[n]$ of a linear time invariant system is given as

$$h[n] = \begin{cases} -2\sqrt{2} & n = 1, -1 \\ 4\sqrt{2} & n = 2, -2 \\ 0, & \text{otherwise} \end{cases}$$

If the input to the above system is the sequence $e^{j\pi n/4}$ then the output is

- (a.) $4\sqrt{2} e^{j\pi n/4}$
- (b.) $4\sqrt{2} e^{-j\pi n/4}$
- (c.) $4e^{j\pi n/4}$
- (d.) $-4e^{j\pi n/4}$

59. Let $x(t)$ and $y(t)$ (with Fourier transforms $X(f)$ and $Y(f)$ respectively) be related as shown in the figure.

Then $Y(f)$ is



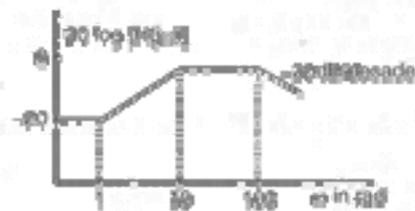
- (a.) $-\frac{1}{2} X(f/2) e^{-j2\pi f}$
- (b.) $-\frac{1}{2} X(f/2) e^{j2\pi f}$
- (c.) $-X(f/2) e^{j2\pi f}$
- (d.) $-X(f/2) e^{-j2\pi f}$

60. Consider the signal $x(t)$ shown in the figure. Let $h(t)$ denote the impulse response of the filter matched to $x(t)$, with $h(t)$ being non-zero only in the interval 0 to 4 sec. The slope of $h(t)$ in the interval $3 < t < 4$ sec is



- (a.) $\frac{1}{2} \text{sec}^{-1}$
 (b.) $-\text{sec}^{-1}$
 (c.) $-\frac{1}{2} \text{sec}^{-1}$
 (d.) 1sec^{-1}

61. Consider the Bode magnitude plot shown in the figure. The transfer function $H(s)$ is

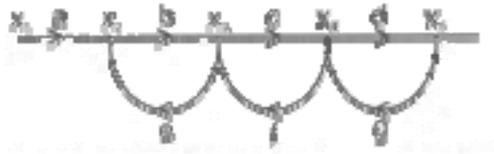


- (a.) $\frac{(s+10)}{(s+1)(s+100)}$
 (b.) $\frac{10(s+1)}{(s+10)(s+100)}$
 (c.) $\frac{10^2(s+1)}{(s+10)(s+100)}$
 (d.) $\frac{10^3(s+100)}{(s+1)(s+10)}$

62. A causal system having the transfer function $H(s) = \frac{1}{s+2}$ is excited with $10u(t)$. The time at which the output reaches 99% of its steady state value is
 (a.) 2.7 sec
 (b.) 2.5 sec
 (c.) 2.3 sec
 (d.) 2.1 sec
63. A system has poles at 0.01 Hz, 1 Hz and 80 Hz; zeros at 5 Hz, 100 Hz and 200 Hz. The approximate phase of the system response at 20 Hz is
 (a.) -90°
 (b.) 0°
 (c.) 90°

(d.) -180°

64. Consider the signal flow graph shown in the figure. The gain $\frac{x_5}{s_1}$ is



- (a.) $\frac{1 - (be + cf + dg)}{abc}$
 (b.) $\frac{bedg}{1 - (be + cf + dg)}$
 (c.) $\frac{abcd}{1 - (be + cf + dg) + bedg}$
 (d.) $\frac{1 - (be + cf + dg)bedg}{abcd}$

65. The open-loop transfer function of a unity feedback system is $G(s) = \frac{K}{s(s^2 + s + 2)(s + 3)}$. The range of K for which the system is stable is

- (a.) $\frac{21}{4} > K > 0$
 (b.) $13 > K > 0$
 (c.) $\frac{21}{4} < K < \infty$
 (d.) $-6 < K < \infty$

66. For the polynomial

$P(s) = s^5 + s^4 + 2s^3 + 2s^2 + 3s + 15$, the number of roots which lie in the right half of the s -plane is

- (a.) 4
 (b.) 2
 (c.) 3
 (d.) 1

67. The state variable equations of a system are:

1. $\dot{x}_1 = -3x_1 - x_2 + u$
2. $\dot{x}_2 = 2x_1 \quad y = x_1 + u$

The system is

- (a.) controllable but not observable

- (b.) observable but not controllable
 (c.) neither controllable nor observable
 (d.) controllable and observable

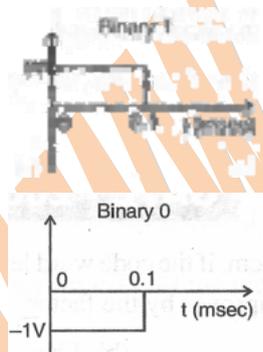
68. A system described by the following differential equation $\frac{d^2 y}{dt^2} + 3\frac{dy}{dt} + 2y = x(t)$ is initially at rest. For input $x(t) = 2u(t)$, the output $y(t)$ is

- (a.) $(1 - 2e^{-t} + e^{-2t})u(t)$
 (b.) $(1 + 2e^{-t} - 2e^{-2t})u(t)$
 (c.) $(0.5 + e^{-t} + 1.5e^{-2t})u(t)$
 (d.) $(0.5 + 2e^{-t} + 2e^{-2t})u(t)$

69. Given $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, the state transition matrix e^{At} is given by

- (a.) $\begin{bmatrix} 0 & e^{-t} \\ e^{-t} & 0 \end{bmatrix}$
 (b.) $\begin{bmatrix} e^t & 0 \\ 0 & e^t \end{bmatrix}$
 (c.) $\begin{bmatrix} e^{-t} & 0 \\ 0 & e^{-t} \end{bmatrix}$
 (d.) $\begin{bmatrix} 0 & e^t \\ e^t & 0 \end{bmatrix}$

70. A source produces binary data at the rate of 10 kbps. The binary symbols are represented as shown in the figure.



The source output is transmitted using two modulation schemes, namely Binary PSK (BPSK) and Quadrature PSK (QPSK). Let B_1 and B_2 be the bandwidth requirements of BPSK and QPSK respectively. Assuming that the bandwidth of the above rectangular pulses is 10 kHz, B_1 and B_2 are

- (a.) $B_1 = 20$ kHz, $B_2 = 20$ kHz
 (b.) $B_1 = 10$ kHz, $B_2 = 20$ kHz
 (c.) $B_1 = 20$ kHz, $B_2 = 10$ kHz

(d.) $B_1 = 10 \text{ kHz}$, $B_2 = 10 \text{ kHz}$

71. A 1 mW video signal having a bandwidth of 100 MHz is transmitted to a receiver through a cable that has 40dB loss. If the effective one-sided noise spectral density at the receiver is 10^{-20} Watt/Hz, then the signal-to-noise ratio at the receiver is

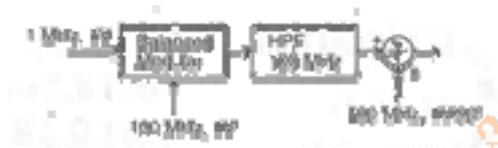
(a.) 50 dB

(b.) 30 dB

(c.) 40 dB

(d.) 60 dB

72. A 100 MHz carrier of 1 V amplitude and a 1 MHz modulating signal of 1 V amplitude are fed to a balanced modulator. The output of the modulator is passed through an ideal high-pass filter with cut-off frequency of 100 MHz. The output of the filter is added with 100 MHz signal of 1 V amplitude and 90° phase shift as shown in the figure. The envelope of the resultant signal is



(a.) Constant

(b.) $\sqrt{1 + \sin(2\pi \times 10^6 t)}$

(c.) $\sqrt{5/4 - \sin(2\pi \times 10^6 t)}$

(d.) $\sqrt{5/4 + \sin(2\pi \times 10^6 t)}$

73. Two sinusoidal signals of same amplitude and frequencies 10 kHz and 10.1 kHz are added together. The combined signal is given to an ideal frequency detector. The output of the detector is

(a.) 0.1 kHz sinusoid

(b.) 20.1 kHz sinusoid

(c.) a linear function of time

(d.) a constant

74. Consider a binary digital communication system with equally likely 0's and 1's. When binary 0 is transmitted the detector input can lie between the levels - 0.25V and + 0.25V with equal probability; when binary 1 is transmitted, the voltage at the detector can have any value between 0 and 1V with equal probability. If the detector has a threshold of 0.2V (i.e., if the received signal is greater than 0.2V, the bit is taken as 1), the average bit error probability is

(a.) 0.15

(b.) 0.2

(c.) 0.05

(d.) 0.5

75. A random variable X with uniform density in the interval 0 to 1 is quantized as follows:

If $0 \leq X \leq 0.3$, $X_q = 0$

If $0.3 < X \leq 1$, $X_q = 0.7$

where X_q is the quantized value of X .

The root-mean square value of the quantization noise is

- (a.) 0.573
- (b.) 0.198
- (c.) 2.205
- (d.) 0.266

76. Choose the correct one from among the alternatives A, B, C, D after matching art item from Group 1 with the most appropriate item in Group 2.

Group 1

- A. FM
- B. DM
- C. PS K
- D. PCM

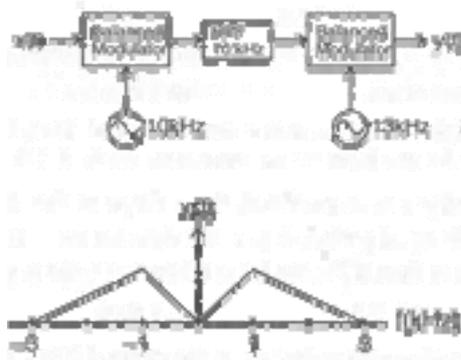
Group 2

- 1. Slope overload
- 2. μ -law
- 3. Envelope detector
- 4. Capture effect
- 5. Hubert transform
- 6. Matched filter

Codes;

- | | A | B | C | D |
|------|---|---|---|---|
| (a.) | 5 | 1 | 6 | 4 |
| (b.) | 4 | 6 | 1 | 5 |
| (c.) | 4 | 1 | 6 | 2 |
| (d.) | 6 | 3 | 4 | 2 |

77. Three analog signals, having bandwidths 1200 Hz, 600 Hz and 600 Hz, are sampled at their respective Nyquist rates, encoded with 12 bit words, and time division multiplexed. The bit rate for the multiplexed signal is
- (a.) 115.2 kbps
 - (b.) 28.8 kbps
 - (c.) 57.6 kbps
 - (d.) 38.4 kbps
78. Consider a system shown in the figure. Let $X(f)$ and $Y(f)$ denote the Fourier transforms of $x(t)$ and $y(t)$ respectively. The ideal HPF has the cutoff frequency 10 kHz.



The positive frequencies where $Y(f)$ has spectral peaks are

- (a.) 1 kHz and 24 kHz
 (b.) 2 kHz and 24 kHz
 (c.) 1 kHz and 14 kHz
 (d.) 2 kHz and 14 kHz
79. A parallel plate air-filled capacitor has plate area of 10^{-4} m^2 and plate separation of 10^{-3} m . It is connected to a 0.5 V, 3.6 GHz source. The magnitude of the displacement current is ($\epsilon_0 = 1/36\pi \times 10^{-9} \text{ F/m}$)
- (a.) 10 mA
 (b.) 100 mA
 (c.) 10 A
 (d.) 1.59 mA
80. Consider a 300Ω , quarter-wave long (at 1 GHz) transmission line as shown in the figure. It is connected to a 10V, 50Ω source at one end and is left open circuited at the other end. The magnitude of the voltage at the open circuit end of the line is



- (a.) 10V
 (b.) 5 V
 (c.) 60 V
 (d.) $60/7 \text{ V}$
81. If $\vec{E} = (\hat{a}_x + j\hat{a}_y) e^{jkz - j\omega t}$ and $\vec{H} = \left(\frac{k}{\omega\mu}\right) (\hat{a}_y + j\hat{a}_x) e^{jkz - j\omega t}$, the time averaged Poynting vector is
- (a.) null vector
 (b.) $\left(\frac{k}{\omega\mu}\right) \hat{a}_z$

(c.) $\left(\frac{2k}{\omega\mu}\right)^{\wedge} a_z$

(d.) $\left(\frac{k}{2\omega\mu}\right)^{\wedge} a_z$

82. Consider an impedance $Z = R + jX$ marked with point P in an impedance Smith chart as shown in the figure. The movement from point P along a constant resistance circle in the clockwise direction by an angle 45° is equivalent to



- (a.) adding an inductance in series with Z
 (b.) adding a capacitance in series with Z
 (c.) adding an inductance in shunt across Z
 (d.) adding a capacitance in shunt across Z
83. A plane electromagnetic wave propagating in free space is incident normally on a large slab of lossless, non-magnetic, dielectric material with $\epsilon > \epsilon_0$. Maxima and minima are observed when the electric field is measured in front of the slab. The maximum electric field is found to be 5 times the minimum field. The intrinsic impedance of the medium should be
- (a.) $120 \pi \Omega$
 (b.) $60 \pi \Omega$
 (c.) $600 \pi \Omega$
 (d.) $24 \pi \Omega$
84. A lossless transmission line is terminated in a load which reflects a part of the incident power. The measured VSWR is 2. The percentage of the power that is reflected back is
- (a.) 57.73
 (b.) 33.33
 (c.) 0.11
 (d.) 11.11
85. The 8255 Programmable Peripheral Interface is used as described below.
- A. An A/D converter is interfaced to a microprocessor through an 8255. The conversion is initiated by a signal from the 8255 on Port C. A signal on Port C causes data to be strobed into Port A.
- B. Two computers exchange data using a pair of 8255s. Port A works as a bidirectional data port supported by appropriate handshaking signals.
- The appropriate modes of operation of the 8255 for (A) and (B) would be

- (a.) Mode 0 for (A) and Mode 1 for (B)
(b.) Mode 1 for (A) and Mode 0 for (B)
(c.) Mode 2 for (A) and Mode 0 for (B)
(d.) Mode 2 for (A) and Mode 1 for (B)
86. The number of memory cycles required to execute the following 8085 instructions
- A. LDA 3000 H
B. LXI D, FOFIH
C. would be
- (a.) 2 for (A) and 2 for (B)
(b.) 4 for (A) and 3 for (B)
(c.) 3 for (A) and 3 for (B)
(d.) 3 for (A) and 4 for (B)
87. Consider the sequence of 8085 instructions given below.
LXI H, 9258, MOV A, M, CMA, MOV M, A
Which one of the following is performed by this sequence?
- (a.) Contents of location 9258 are moved to the accumulator
(b.) Contents of location 9258 are compared with the contents of the accumulator
(c.) Contents of location 9258 are complemented and stored in location 9258
(d.) Contents of location 5892 are complemented and stored in location 5892
88. It is desired to multiply the numbers 0AH by 0BH and store the result in the accumulator. The numbers are available in registers B and C respectively. A Part of the 8085 program for this purpose is given below:
- MVI A, 00H
Loop; -----

HLT END
- The sequence of instruction to complete the program would be
- (a.) JNZ LOOP, ADD B, DCR C
(b.) ADD B, JNZ LOOP, DCR C
(c.) DCR C, JNZ LOOP, ADD B
(d.) ADD B, DCR C, JNZ LOOP